The Tool Engineer

Vol. III. No. 12.

APRIL

1935

IN THIS ISSUE

For 1935
the Tool Engineer's
outlook is bright

See Page 8

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Official Publication of the

AMERICAN SOCIETY OF TOOL ENGINEERS

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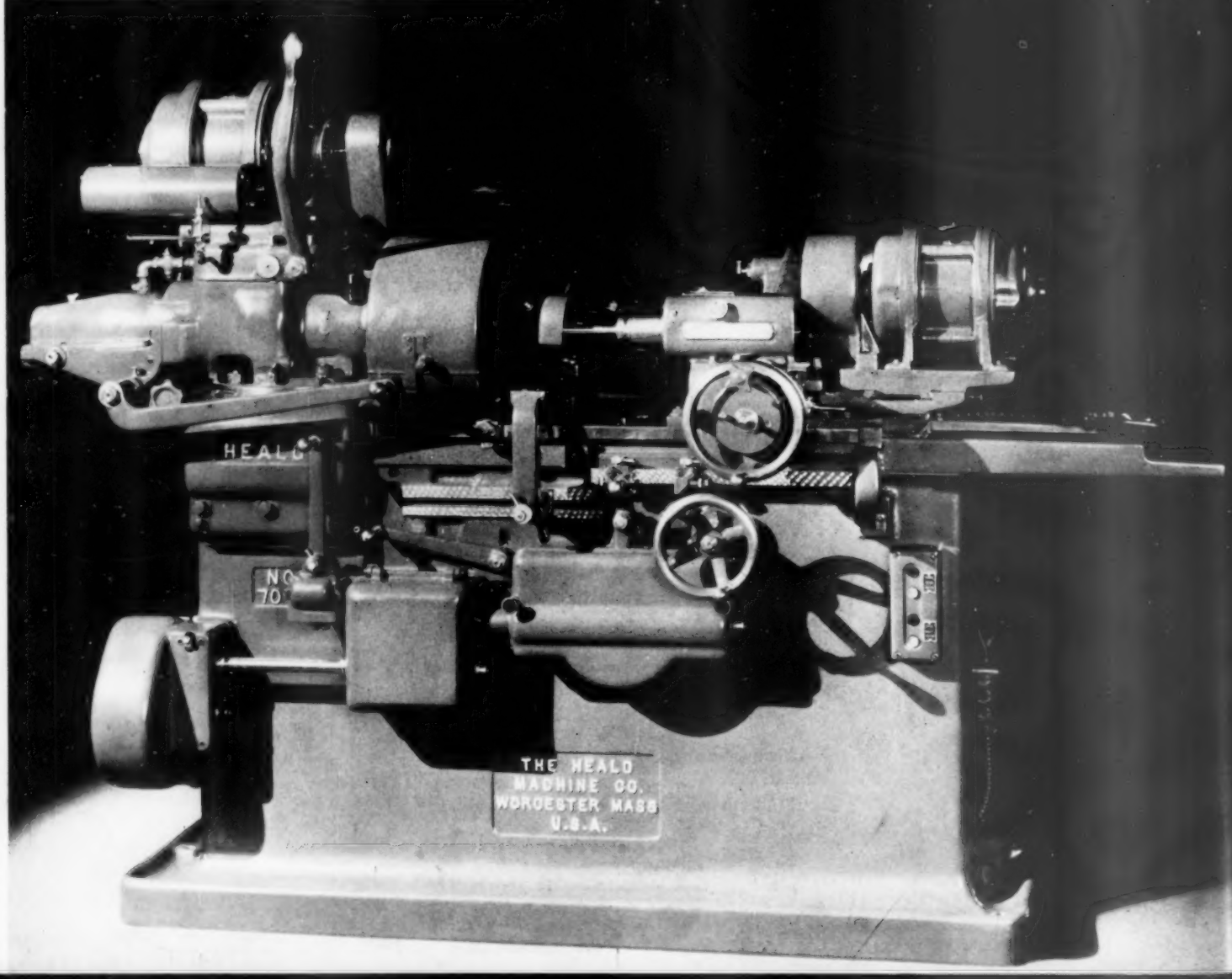

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189

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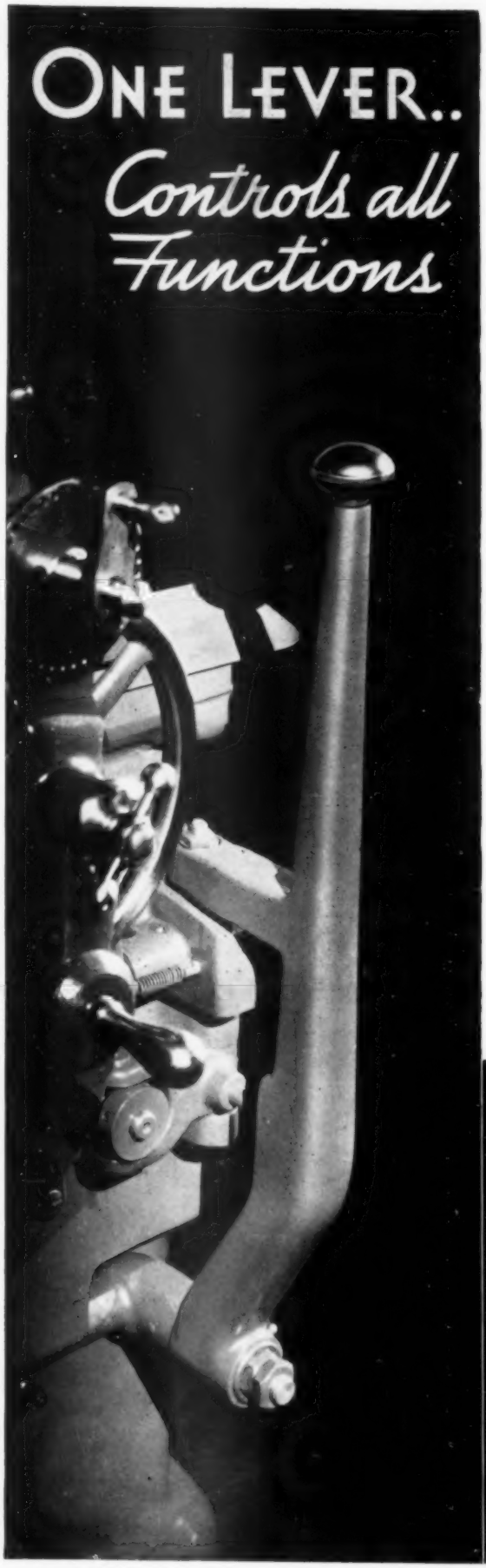

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This publication is giving identity to the profession of tool engineering—help this cause by mentioning *The Tool Engineer* to advertisers.

The Tool Engineer

Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. III | April, 1935 | No. 12

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The Tool Engineer is published on the first Thursday of each month. It is the official publication of the American Society of Tool Engineers, Incorporated. The membership of the Society and readers of this publication are practical manufacturing executives such as master mechanics, works managers, tool engineers, tool designers and others who are responsible for production in hundreds of plants throughout the nation and in foreign countries.

Owing to the nature of the American Society of Tool Engineers organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

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• No industry has made greater progress than the automotive industry. Much of this progress is attributable to the Tool Engineer that able practical production executive who has lessened unit costs and made possible a multitude of better products within the reach of the masses. No single factor has aided him more than precision measurements and the resultant interchangeability of parts. The May issue of *The Tool Engineer* will deal with this all-important subject. Widely known authorities will contribute articles you will not want to miss. You will want to *keep* your copy of this special edition.

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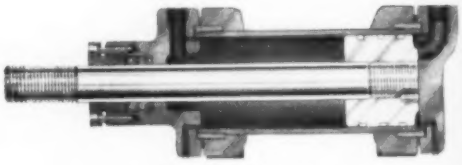
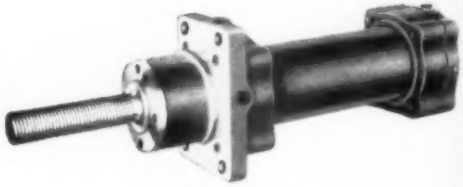
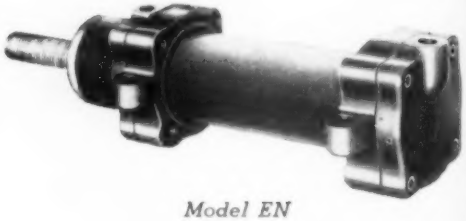


Sectional View

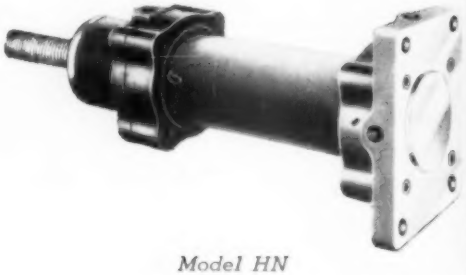
Model CN



Model JN



Model EN



Model HN

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No Leakage: A perfect piston seal is provided through mirror-finish of the cylinder on a special Hannifin long-stroke honing machine. The cylinder bore thus produced is straight, round, perfectly smooth, and concentric with the end caps. Lasting leak-proof construction is obtained, with a simple assembly, by this precise manufacture.

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APRIL MEETING

(DETROIT)

HOTEL FORT SHELBY BALLROOM

April 11th, (Thursday)

Dinner: 6:30 p.m.

Meeting: 8:00 p.m.

Speaker: **A. H. d'Arcambal, Pratt & Whitney Company, Hartford, Conn.**

Subject: **"A Practical Talk on the Machinability of Metals."**

A. H. d'ARCAMBAL
Consulting Metalurgist
Pratt & Whitney Company,
Hartford, Connecticut

Special Entertainment and Music will be a feature of this occasion. *"It'll be different this time."*

ALEXANDER H.d'ARCAMBAL was born in Kalamazoo, Michigan, January 23, 1890. He attended Detroit Central High School and was graduated from the University of Michigan with the degree B. of Ch. E. in 1912.

Since his graduation, Mr. d'Arcambal has been associated with Detroit Copper and Brass Rolling Mills as a chemist, 1912-1913. In 1913-1914 he was connected with Chalmers Motor Car Company in the capacity of chemist and metallurgist. From 1915 to 1918 he was Chief Chemist at Dodge Brothers. In 1918-1919, Mr. d'Arcambal was associated with the Wright-Martin Aircraft Corporation as a metallurgist. In 1919 he joined the Pratt & Whitney Company, Hartford, Connecticut in the capacity of Chief Metallurgist. More recently he has been made Sales Manager of the small tools division of the Pratt & Whitney Company and is also Consulting Metallurgist for the Company.

Mr. d'Arcambal has been very active in promoting the profession in which he is so interested, through his many activities with the American Society for Metals. He has served as Chairman of the Hartford Branch of this Society, has served on the Directorate and has been Vice-President and President of this important body. He has addressed every branch of this Society during the past ten years and has also served on several committees of the national headquarters.

On the subjects of gages, small tools and tool steels, Mr. d'Arcambal is an authority. He will illustrate his paper before this meeting with stereopticon slides and no doubt will have exhibits to exemplify various phases of his paper. Every production executive should attend this highly important and interesting meeting. Make your dinner reservations direct to the Secretary's Office by mail or telephone in Detroit, MAdison 2057. This is an open meeting—anyone interested is invited to come. *This will probably be the last dinner meeting of the present season. New officers, recently elected, will also be installed at this meeting.*

To participate in the Prize Drawing make your reservations in advance. Tickets purchased at the door will not carry the prize contest stubs.

PRODUCTION PERSPECTIVES

• • •

We've been keeping our ear to the ground the past few days for big news to broadcast on this page. In the tool engineer's world this is the biggest news we know of: So far as 1935 is concerned, we are in the "seasonable" slump **now**—and that's not so bad with every tool engineer we know of busy on his job. The really big news is, **programs** undoubtedly **will be under way three months earlier** this year—and that means **little possibility of a summer slump.** What's the reason? One is that cars are being sold—lots of them, and prospects sure do look good. Try and find a pessimist these days. All motor car manufacturers are going strong—even the higher priced cars such as Packard's New 120 Model. Production on this car is mounting every day—in fact the **Packard Company** has practically **reached the point of production they are tooled up for** . . . . and, you recall, no doubt, they spent some six million dollars for tooling this model alone. **Lincoln,** too, are going at full tilt. Their **large car sales** must have **exceeded** their **expectations** . . . . or, are they getting ready for a **new lower priced model** ? ? ? The early fall, no doubt, will be the time of introduction for the new model—if there is one under way at this plant . . . . and, we **think** there is. Most production men are aware that **Ford's production** is now about **seven thousand a day.**

It's spring now—when young men's fancies (and some old timers, too) turn to thoughts of love . . . . and other things like boats. Among A.S.T.Eers and others who are scrubbing or scraping hulls these days are **E. J. Hunt, George Vis, Al. Williams, Perce Garland, Chick Austerberry and Bill Fors.** Bill was also recently made Secretary of the Detroit River Yachting Association **for the eighth consecutive year. Sid Probert,** who was until recently Assistant Master Mechanic to E. J. Hunt at Chrysler Plymouth plant, we hear is now located with **Timkin-Detroit Axle Company. Dan Karpinski A.S.T.Eer** who has been with Motor City Tool is now located with a newly organized firm—the **Westlof Tool and Die Company** located at 428 Bellevue Avenue in Detroit. **Robert Westrick** and **John Loffler** old timers in the business are the new owners of this company. Dan Karpinski will have charge of designing and sales for the new company.

A.S.T.Eers all wish **Al. Williams** luck in his new plant on Russell Street at Milwaukee, in Detroit, where his company the **Tool Engineering Company** will now be established. **Bill Smila,** President and **Frank Gertiser,** Secretary-Treasurer of the A.S.T.E. Speakers' Club state their club is making good progress. They are now getting ready for a special entertainment which they will give at a future A.S.T.E. meeting. "More tool engineers should be in this club," says Bill. "Why not, at only $5 for the season—and think of the fun we have". Interested members and their friends should call Mr. Smila or Secretary Sargent's office.

Tool Engineers and production men will be sorry to learn of the death of **Robert Warren Davis,** an oldtime machine broker. He was well known in the Michigan area and had been in the business for a great many years. **Arthur Moquin** of the **National Tool Salvage Company,** where he is factory manager is now back from a grand vacation in the East—ask him about it. Did you notice the nice turnout from **Flint, Toledo and Jackson** at our last meeting in Detroit on March 14th? Some of those who were present included the following from the **A C Spark Plug Company** at Flint, **E. L. Benson, A. McMillan, Sam Moore, P. W. Rhames, J. A. Anderson, L. H. Benson, F. C. Hodges, L. G. Hunt** and **R. Old. Walter Dalby** of **Buick** was also present from Flint. **George Melling, Sr.** of Jackson came in, and **H. L. Tigges, G. Temple** and **Mr. William Baker** of Baker Brothers in Toledo were present. **Rudolph O. Stephan,** Flint A.S.T.Eer, also attended this meeting.

The **Machine Tool Builders** have asked the American Society of Tool Engineers to **sponsor one** or **two sessions** at their Exposition in **Cleveland, September 10-21st.** Nothing has, as yet, been officially decided by the Society in regard to this, but there is **considerable interest in promoting a trip** *enmass* **to Cleveland** for this important event. It has been suggested that the Society **charter an entire steamer** for the occasion, thus providing accommodations for all interested tool engineers and production executives from the Michigan area. We think this is a splendid idea—don't you? Why not tell your friends about it . . . and, most of all, get in touch with your Board of Directors or our Entertainment Committee—let them know how you feel about this. The **entire trip will be very nominal in cost** . . . . **and, for a good time, well** . . . . remember the Cincinnati trip?

Hydraulic Feed Mechanisms for Drilling and Boring Machines and Electrical Controls

AS GIVEN BEFORE APRIL 11th MEETING OF A.S.T.E. IN DETROIT by R. Shafer

MR. Chairman and gentlemen: I have spent about sixteen years directly and indirectly connected with automotive tool production in this part of the country and for a period of ten years, I have been closely associated with the design of drilling and boring machine employing hydraulic feeding means. I shall, therefore, confine my remarks this evening to the drilling and boring machine applications.

First, let me call your attention to the fact that the advent of hydraulic feed application to machine tools, took place at the beginning of the period of rapid expansion in the mechanical production field. Because of this, the machine tool engineer was faced with two major problems. First, with applying the hydraulic feed to the various types and sizes of machine. This was no small undertaking because people who were used to screw or cam operated movements expected the same physical action in the hydraulically operated parts, and the simple fact is that they cannot have it.

Second—the hydraulic feed had to be far more flexible than the replaced mechanical feed to meet the demands of the user. Better cutting tools increased the use of high speeds and feeds. The better alloy steels increased the power requirements. Higher production and continuous operation demanded higher rates of traverse to and from the work and heavier, better-built machines.

Permit me to say at this time that the machine tool manufacturers differ from most other engineering companies in that their products are sold to other engineers. While this has its advantages, it sometimes results in the engineer buyer insisting on the incorporation in the design of many small features which are possibly little more than personal fancies.

The transmission of power by fluid means is not a new theory or a recent discovery. In the very early days of mechanics, fluid power transmission was successfully used. The fundamental principles are the same for various hydraulic applications, but specialized knowledge of the industrial uses is necessary for the successful application of hydraulic power on machine tools.

While the word hydraulic is generally used, it should be understood that oil is most generally used as a medium. The use of oil in our hydraulic systems is partially responsible for the great progress of the past ten years of development. Oil is non-corrosive and lubricating. These features allow the engineer to choose the most suitable materials without being limited to non-corroding types or give attention to the lubrication of moving parts. Oil is also practically incompressible and chemically stable, which is very essential if an accurate control of flow is to be obtained.

If a compressible fluid is used, trouble is encountered due to contraction in volume when subjected to pressure. The non-compressible feature of oil may easily be destroyed if air is allowed to enter the system. The best method which can be used to prevent air from entering the oil is to completely submerge all of the transmission—pump, valves, cylinders, etc.,—in the oil reservoir.

If this method is not practical, the next best method is to locate the reservoir above as much of the mechanism as possible. Care must also be taken to discharge the oil into the reservoir in such a manner as to eliminate any churning action which will draw minute air bubbles into the oil. When minute air bubbles once enter the oil, they do not escape at once because of the comparatively high viscosity of oil.

One of the first machine tools to be successfully introduced with hydraulic feed, was the broaching machine. On this type of machine a slight irregularity in the rate of feed movement was found to be beneficial rather than detrimental to the operation of the broaching cutter. Today, we find the hydraulic broaching machine universally accepted as a better tool.

Later developments introduced the hydraulic feed drilling machines, closely followed by the boring, milling, shaping, and planing machines.

When the hydraulic feed means was applied to these tools, various problems confronted the engineer. The better developed hydraulic equipment available was either too expensive or not adaptable to the design. After ten years of development, we did find several different systems in use by the machine tool manufacturers. Although details may vary considerably, there is in nearly all cases, a double-acting cylinder and piston secured to the table or slide to be fed, which piston is operated by a hydraulic pump.

R. SHAFER

In a drilling, boring or milling machine, the rotating cutting tool must be advanced at a ratio proportional to the rotation speed. This means that the feeding means must be closely synchronized with the rotation power means. This necessitates some regulating device to determine the rate of feed of the hydraulic traverse means and to prevent fluctuation of the rate due to variations in the load conditions. This means regulating the hydraulic feed rate is divided into two distinct classes.

First, the control of flow through an aperture. This is based on the established theory that a given quantity of oil will pass through an orifice in a certain length of time if the pressure on the oil and the viscosity of the oil remain constant. To successfully apply this system of feed or rate control, it is necessary to maintain a constant pressure differential across the aperture or orifice. Various types of pressure differential devices are in use at the present time. Very little has been done to regulate the viscosity of the oil which changes due to the temperature change. We have selected grades of oil having the best or flattest viscosity curves and provided circuits with a minimum heat creation. Much is yet to be done in the development of this type of control.

The second type of control is the measuring or metering system. This is based on the principle of measuring a predetermined amount of oil by means of an adjustable measuring device. Generally this device is a volumetric piston type of pump. In this system, more mechanical apparatus is necessary and therefore, more points of leakage are found. These points of leakage are effected by the viscosity of the oil and the pressure applied.

The Oil Gear Company has developed a device which adjusts the volume capacity of their pump to compensate for the change in viscosity. I am unable to state how successful this device is in practice. This adjustment by thermal elements can be applied to either type of control if it proves satisfactory in service.

The pioneers in the hydraulic feed designs were unable to purchase pumps, valves, etc., at a price permissible for use on their machines or easily adaptable. Today there are several manufacturers of suitable pumps, valves, etc. There is also now available much more data on the subject of hydraulic machine tool feeds.

Because of increasing demands for higher production per machine and the combination of operations performed on one machine, we are continually trying new schemes. Our demonstrators are, therefore, never able to become familiar with all of the details of the machine when they are called to service them. At the plant we are continually besieged with requests for advice and help from our service men. Often we are sorely puzzled by the accounts of the trouble and our advice more or less is a guess.

I wish at this time to briefly describe several well-known hydraulic feed circuits in use on drilling and boring machines.

At this point slides were projected. Slide: This circuit is commonly called a locked circuit system. A geared pump of the constant volume, low pressure type is used for rapid traverse movements. For feed movements, an adjustable volumetric piston-type pump is used. This pump is of radial character having five small pistons and a rotary taper valve. A spool sliding type valve is used to select the pump and direct the flow to the actuating cylinder. The slide shows the feeding or working circuit position.

The variable displacement pump is directly connected to the actuating cylinder. The inlet or suction side of the pump is connected to the non-working side of the cylinder, while the pressure side is connected to the outlet or pressure side of the pump. The theory of this circuit is that this direct connection makes it impossible for the actuating cylinder piston to move except as forced by the pump. Let us examine this feed circuit in detail.

Oil on the non-working side of the actuating side of the cylinder is under very low pressure. This oil is forced into the inlet or suction side of the pump. The pump rotates. The rotary valve in timed relation with the crank or eccentric carries the oil over to the outlet or pressure side. On the side of the pump, the oil is forced out under pressure to the pressure or work side of the actuating cylinder. To make the theoretical circuit practical, an efficiency of one hundred per cent would be necessary.

When the oil is sucked in at five pounds or ten pounds pressure, practically no leakage takes place at the moving parts. When this same volume is subjected to five hundred to one thousand pound pressure, the same leakage must take place at the moving parts. In the pump we find five small pistons which must be fitted loosely enough to allow rapid reciprocation. We also find a rotating directional valve with sealing points at either end. After leaving the pump, the oil flows to the selector valve. Here we find two more sealed points. The sliding piston in this valve must be free to reciprocate.

The flow then enters the actuating cylinder and we find another point of leakage around the piston which must also be free to reciprocate. If a piston rod is used at this end, another point of leakage is established. There are, therefore, ten or eleven points in this system. It, therefore, becomes evident that the oil supplied to the inlet side of the pump must be greater than the actual amount delivered at the pressure side of the actuating cylinder so as to compensate for the leakage losses. One means of accomplishing this is to make the actuating cylinder a differential type of cylinder in which the largest area is connected to the intake side of the pump. Since it is impossible to accurately determine the hydraulic efficiency of the system, it is necessary to supply ample extra supply and for this reason either a permanent leak of small capacity or a low pressure by-pass valve, must be installed in the intake side of the pump.

Because of the change necessitated to make this system practical, we then find that the locked features of the system have been destroyed. Since the non-working side of the actuating cylinder is open to low pressure through a permanent leakage or by-pass valve, there is nothing to prevent the piston from moving toward this end of the cylinder if so urged.

On the average drilling machine installation, a

(Continued on page 14)

VOCATIONAL ORGANIZATION

★ by A. E. Rylander

Member A.S.T.E.

This is the third in this series of articles by Mr. Rylander. In this installment he reaches the crux of this mooted subject among creative workers. The fourth and last part of the series will be published in the next issue of *The Tool Engineer*.

I CONCLUDED the previous chapter with the comment that management, the conservative engineering society and the draftsmens' union, so called, have much in common; that their differences were not so much in objectives, as the methods of achieving them. Let us consider these methods from various angles. The unions propose a 30 hour week with a salary of $250.00 per month, to which no one can object provided it doesn't benefit the few at the expense of the many. Unfortunately, the results would be just that, as I shall show.

Before a new industrial project can be put in production, it must first be engineered, experimented with until the wrinkles are ironed out, designed and detailed, then, last but not least, *tooled*. This calls for a range of ability, training and experience which by no gage of justice can be equally compensated. To level wages, as reducing the salary of the trained engineer, or to advance wages in the lower brackets comparably to the higher, would at once clamp a brake on incentive and so lower rather than promote engineering standards. Yet, in effect, that is exactly what unionism aims at, all claims and protestations to the contrary notwithstanding. Its organizers, when exhorting draftsmen to rally to its standards, cite their successes (never their failures) in effecting wage increases among brick masons, mill operatives and production workers, yet, carefully omit reference to the fact that these workers cannot advance without stepping out of their class. Their product is limited to an average, and even if on piecework production must be limited, lest they suffer at the hands of slower workers. Wage levels, then, work no great injustice in the production line; they are, however, unfair and retrogressive in the engineering office. Even Russia, that workingman's Utopia, has come to realize that communism cannot level humanity, and is now scaling wages commensurate to training and ability. It had to come to it, as it will eventually revert to class distinction, if by no other demarcation than intelligence and dumbness. So, why rush headlong into experiments proven impractical, when there are better ways that show promise of success? Cooperation, for instance, and unselfish consideration for the many, rather than selfish regard for the few.

Management Not Averse

Contrary to the persecution complex of the professional organizer, management is not averse to organization among draftsmen; it is, however, disappointed that a minority of engineering workers should have adopted union principles, and so, I frankly believe, are the majority of the more capable men in the designing fields, since the draftsman, by every law of affinity, belongs on the side of management. Industrial management is largely drawn from the ranks of these workers, a statement so obviously true that elaboration is unnecessary, beyond saying that the most prominent men in industry today have come up from the ranks, and most of them have pushed a pencil across a sheet of bond or duplex. There is, then, a bond of a sort between the draftsman and his boss; both are trained, to a degree, along the same lines.

Because of that, management viewed organization among draftsmen with friendly but critical interest, with a hope that these would produce something new in vocational organization. And have the Knights of the Pencil produced a new design, so to say? Well, not yet—at least, the unions haven't. Rather, they have traced from old layouts; have projected their programs along the lines of the manual workers, have adopted their principles and objectives, but, so far, *have not advanced a single constructive or tenable idea as to how these objectives are to be attained*. More money and shorter hours—we all want that, but, the problem is how to eat your cake and have it, too. To say that the boss is averse to these ends is silly, since he was the first to propose it. In this, management has the advantage; it is more intelligent and broader visioned than the average worker, also, it has the advantage of being able to think and plan individually or in small groups. It may be assumed, on that basis, that the short week and the fat envelope have been considered on their merits; the results are a matter of time.

Conceding all the advantages of the 30 hour week and the minimum salary considered by the unions, I cannot see how this Utopian state can be immediately achieved without invoking the law of the survival of the fittest, and unfortunately, the draftsman is in the tough spot of being quite subject to that law. The proponents of the 30 hour week claim that it will spread employment. On snap judgment, it will—among the production workers. Analyzed to a conclusion, however, it will not work out that way, instead, it will seriously jeodardize the draftsman, and, to a lesser degree, the production worker. Because, the production worker is not an expense man, *while the draftsman is*, and on that difference hinges the success or failure of his program. The draftsman is not essential to industry; he is only essential to progress, and not all draftsmen contribute directly to that. Dumb or intelligent, the production worker turns out his allotted stint, but not so the draftsman, whose work

is creative (unless he be a detailer or copier) and whose value is determined by personal qualities. All draftsmen are not equally capable, nor equally productive or inventive. One may project a million dollar idea, and carry it to a conclusion, while his fellows plod along in a rut of mediocrity. If it came to a forced issue, which man would work, or what proportion would be hired at, say $250.00 per month for a 30 hour week? Have you ever considered it from that angle?

The immediate result of the 30 hour week, at that wage, would be to practically double preliminary costs of engineering and tooling, and so, would discourage consideration of invention, since only the larger corporations, with their research divisions, could afford to carry on development and experimentation. *And, the men engaged in that work would not be drawn from the ranks of organized labor.*

If, now, a proportionate increase were to prevail all along the line (as proposed by the American Federation of Labor) material and production costs of the lower priced automobiles, to cite one item, would jump sharply. The effect on markets and employment is but a simple problem in elementary economics, something, by the way, that the professional organizer doesn't give a care about, since his sugar is contributed by the boys. To the extent of some $60,000,000.00 divided among 15,000 organizers ($4,000.00 average each) before the depression. What it is now is a matter of conjecture. It certainly is not less.

The Industrial Trend

Management has these problems to contend with. It is not averse to high wages and increased employment, which would enhance its markets, but it is averse to putting the cart before the horse. It must balance costs and selling price, with sufficient profit to insure a reserve; *it must also reconcile high wages and short hours with low costs, that the premature demands of labor may not wreck the market.* I say premature demands, because long before the A. F. L. made an issue of the 30 hour week, and before even the N.R.A. was conceived, management had considered and approved it. Kettering and Ford both agreed that: "Before long, men will be working shorter hours and at bigger wages than they have ever known." These men are visionary and optimistic, but cold analysts of industrial trends. Ford is backing his faith with money—millions of it! The trend, then, is definitely toward the short week and the bigger wage, but, the results are only to be accomplished by slow evolution, not sudden revolution. So, management asks for patience and consideration pending reestablishment of industry and its markets. There are tremendous projects ahead, requiring the services of engineers, designers and draftsmen, and management asks that these, with their superior intelligence and training, temporarily lay aside personal interests and cooperate for the common weal. If this cooperation is not forthcoming, industry will proceed without their help, except as a bare minimum of expense men are required to keep the old wheels turning. The new projects can wait, only, *they don't have to.*

Let us here be honest with ourselves, and leave the kidding to the professional organizer, who, by the way, has yet to contribute a single thought or any worthwhile invention that ever put a handful of men to work, much less an army. A draftsmens' union may demand anything that it will, but, has it any tangible foundation on which to place its artillery, or any weapons of offense whose repercussions would not be more disastrous to the men behind the guns than to the target? Boycott—would this promote employment? Force, picketing, threat of strike—the tools of the unreasoning! And even if these are big powder to the production man, they are blank cartridges—duds!—to the expense man. Get out of the rut and shoot for the stars!—anyone can shoot down a well.

Besides, management has long since anticipated those possibilities, and is prepared, should the issue be prematurely forced. No law, no code yet devised can compel the employer to hire expense men beyond the minimum quota, nor prevent him from eliminating a department entirely, rather than submit. For instance, in a recent strike of body truck drivers, the company involved simply forgot the trucks and reverted to rail shipment. Reason out for yourself the alternatives possible in the case of the draftsmen. For one thing, one has but to consider the engineering schools operated by Chrysler and Western Electric, among many, to concede that preparedness. Then too, a crisis in the relations between draftsmen and their employers would cause a sharp trend toward standardized fixtures, also, a reversion to the special machine, which is capable of a production far higher than the standard machine tool and special fixtures. This would not only affect the draftsmen at large (not so much the qualified designer) but the production worker, with the results all around quite the reverse of the employment gains claimed by the unions. And that's not the half of it—I have only hit the high spots.

The Brighter Side

To show the reverse and brighter side of the picture, I do not believe the draftsman will be cheated, unless he chooses to sell his heritage for a mess of pottage. It is no idle prophecy that America is on the verge of the biggest boom in its history, and with it will come enhanced working conditions, shorter hours and a fatter pay envelope. But to force that issue prematurely, as far as the draftsmen are concerned, would be economic suicide. *Right now, these objectives can only be attained by the few at the expense of the many.* While many engineering workers will move into the higher brackets in the next few years, with the rest absorbed as fast as improving conditions permit, it is still a choice between many men working intermittently at the highest rates the tariff will stand, and a few men steadily employed at 30 hours. In the latter event, the rest would be hopelessly out of the picture, with ample time to wonder how the plausible plans of the professional organizer could possibly have gone haywire. In the final analysis, radical measures (by which is meant destructive radicalism) projected by radical minorities jeopardize not only the engineering profession as a whole, but the interests of the man who wants to work, and who has sufficient faith in himself, and the strength of patience to wait and to build constructively. There is a better way, which I will save until the concluding installment. (To be continued.)

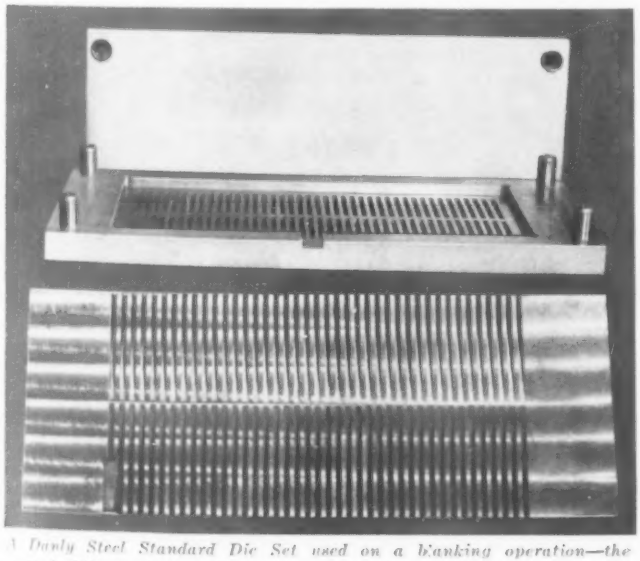
Detroit Tool Engineers Aid Development of All-Steel Die Sets

THE popularity of the standardized all-steel die set in automotive plants of the Detroit area led a number of Tool Engineers to aid in the development of a new line of all-steel shoes and punch holders. These are now being produced by the Danly Machine Specialties Company of Chicago and offer many advantages. They are produced by the torch cut and welding method which afford an economical means for almost any kind of cutting, recessing or building up of sections.

This is not the first time Tool Engineers have effected economies and brought about a standardization of sizes or models for more effective mass production. As a result of this particular work eight types have been selected as of most use to the automotive industry with a series of standardized sizes developed to cover a wide spread of dimensions. These sizes by no means limit the possibilities as any size or shape can be very quickly made up for almost immediate shipment from Chicago. The Danly Steel Standard Sets include:

Round Die Sets—Back Posts
Diameters 6 to 20″
Round Die Sets—Center Post
Diameters 10 to 24″
Rectangular Die Sets—Back Post
6″x12″ to 20″x35″
Rectangular Die Sets—Diagonal Post
6″x8″ to 20″x35″
Rectangular Die Sets—Center Post
10″x12″ to 28″x28″
Rectangular Die Sets—Center Post
10″x30″ to 40″x100″
Four Post Die Sets—
10″x12″ to 28″x28″
Four Post Die Sets—
10″x30″ to 40″x100″
Demountable Boss Sets—

In the Danly Demountable Boss Set, the boss replaces the usual bushing, and is regularly held to the shoe or punch holder by four socket head cap screws.



A Danly Steel Standard Die Set used on a blanking operation—the slotted slide at the bottom carries the stock out of the press.

The bosses are readily removable, thereby also releasing the pins, making the complete surface of the shoe or holder, or the die or punch mounted in them readily available for any type of work.

Danly Demountable Boss Sets are also very useful when more than one die is mounted in the set, as their ready removal of bosses and pins make it very easy to change dies.

Landis New Internal Grinder

THE new Landis Type C Hydraulic Internal Grinders represent the entrance of this company into the production Internal Grinder field. These machines may be used for the rapid production grinding of similar parts within a close degree of accuracy and are so flexible as to serve with equal efficiency for the small lot grinding of a wide variety of work. Two sizes are offered. The 15″x8″ for the grinding of smaller bores and has as its outstanding features the Landis-Solex Sizing Device and a hydraulically reciprocated grinding wheel fixture. The 15″x11″ size is for the deeper bores. The former may be furnished as a plain machine, that is, without automatic sizing or hydraulically reciprocated grinding wheel fixture, when rapid production grinding does not have to be performed. The latter, however, is only supplied with these two high production features on special order.

The Landis-Solex Sizing Device is responsible for the close consistent accuracy of the machine. It functions during the entire grinding cycle directly from the work diameter. As a consequence, such variables as wheel wear, difference in amount of stock to be removed and spring in the grinding wheel quill do not affect its accuracy. It may be used for any straight or tapered hole, whether blind or not. With equal efficiency it will size many splined, key-wayed or interrupted holes. Operation of the device is based on the sensitiveness of change in air pressure. This sensitiveness is made to control machine movements by means of mercury type electric switch and solenoids.

Another important feature is the grinding wheel quill spring compensating device. As a result of its use the cross feed automatically compensates for any spring in the grinding wheel quill, thereby effecting great wheel economies. Bores having steep tapers with angles up to 90° may be handled on the standard machine. Great care has been exercised in order to make all valves, piping and connections easily accessible for inspection. A compact water, oil and air pump mounting of great simplicity is located at the rear of the bed.

The following additional features have been designed into the machine: (a) an Excello ball bearing spindle sturdily supported well out toward the wheel and driven in such a manner as to make certain the delivery of even and ample power to the spindle, regardless of the load; (b) a grinding wheel feed which operates automatically or manually, in either case through the medium of a large feed screw and nut; (c) a simple and effective wheel base hydraulic back lash and (d) a rigidly webbed bed of box type construction, having the water reservoir integral at the rear and the oil reservoir in its base.

fluctuation of plus or minus five per cent in the feeding rate under varying loads may be considered excellent. The most worthy feature of note in this circuit is its simplicity of parts. In a combination high and low pressure system, this is very unusual.

Slide: This circuit is also a combination high-low pressure system. A geared pump is used for the rapid traverse movements. For feed movements, an adjustable volumetric pump of the radial style piston type is used. This pump usually has five small pistons arranged around an eccentric or crank. A spool-type sliding valve is used to select the pump flow and change the direction of flow to the work cylinder. This slide shows the circuit as established for feeding purposes. The piston or feed pump pressure or outlet side is connected to the pressure or work side of the actuating cylinder through the directional valve. The inlet or suction side of the feed pump is supplied with oil by the low pressure, high volume gear pump. The excess volume being by-passed to the reservoir at a relatively low pressure five or ten pounds. Since the feed rate is established by the adjustment of the volumetric pump, we must recognize the fact that any leakage on the pressure side of the system will cause a variation in the rate of feed at the actuator cylinder.

As the amount of leakage will vary as the pressure increases, a variation will be found between the idle feed rate and the working feed rate. We shall, therefore, examine this side of the circuit for points of leakage.

In the pump, we again discover five points of leakage at the reciprocating pistons, also two points, one at each end of the rotating valve. A hydraulic balancing device on the rotating valve adds three more points of leakage. Therefore, there are ten leakage points in the pump alone. The selector valve furnishes two leakage points and the actuator cylinder furnishes one. The total number of leakage points becomes now thirteen.

In this system, when used on an average drilling machine installation, a fluctuation of plus or minus five per cent in the feed rate under varying loads may be considered excellent. A foot valve or by-pass is installed on the opposite end of the cylinder to prevent any external force from urging the piston forward faster than the established feed rate, unless the external force is great enough to overcome the foot valve resistance.

There are several features worthy of note in this system. Pilot type relief or by-pass valves are used where the volume of oil handled is large. The rotating pump valve is hydraulically balanced. By balancing this valve one of the most serious mechanical defects on this style of pump has been eliminated.

Slide: This circuit is an aperture type metering system. In this circuit only one type of pump is used which is a constant volume vane type pump. A directional valve of the sliding spool type is used to direct the flow to the cylinder. A differential regulator and aperture valve is used to meter or regulate the feed rate of traverse. A combination poppet check valve and spool type sliding valve are used to transfer from rapid traverse volume to rate feed volume or control. A by-pass or pressure relief valve is used to maintain a peak pressure for the pump supply.

The circuit is shown as positioned for feeding rate of traverse. The pump section or inlet is direct from the reservoir as the vane type rotating pump is a sucking or self-priming pump. The pressure or outlet side is connected to a by-pass or relief valve. This relief valve maintains a maximum or high pressure peak. The pressure line continues onto the directional valve which directs the flow to the large or working end of the actuating cylinder.

Thus, we find a direct connection made between the pump and the working side of the traverse cylinder with no obstruction to limit the volume. The relief valve does limit the pressure.

The opposite of the work or traverse cylinder is connected to a differential governor and aperture valve. The aperture is an adjustable opening by which means the feeding rate may be adjusted. Since the oil on this side of the cylinder must be exhausted to allow the piston to move as urged by the pressure on the opposite end, the aperture will regulate the movement or rate of feeding traverse. To insure a uniform rate of flow through the aperture, a differential governor is interposed between the cylinder outlet and the aperture valve. This differential governor maintains a pressure at the aperture by regulating the volume allowed to escape, which volume is necessary to maintain the pressure differential. A spool type directional valve in line from the small end of the cylinder cuts off the free flow to the reservoir and directs the flow through the aperture control.

In this system, two factors effect the rate control means. The viscosity of the oil and the pressure across the aperture. We find that a differential governor regulates the pressure across the aperture regardless of the load variations, so we may disregard this factor. No provision has been made to compensate for the variations due to viscosity changes. Since temperature changes will affect the viscosity, all heat production should be limited.

This system shown, however, actually generates heat as the entire volume of the pump must be used in some form of power. Only a small portion of the volume is used for the purpose of feeding traverse at the work cylinder. The remaining volume is by-passed through the relief valve at the maximum pressure and is dissipated in the form of heat in the reservoir. This condition causes some variation in the feeding rate as the machine is started when the oil is cold and gradually becomes heated.

Leakage also affects the rate of feed, but the points of leakage are not as numerous as in the previously discussed systems. At the work cylinder, a leakage point is established at the packing gland around the piston rod and another at the piston. Another point is found in the transfer valve. This is a total of three points of leakage as compared to eleven and thirteen respectively on the previously discussed systems.

Considering the fewer points of leakage, but the greater viscosity change due to heat dissipation, I would estimate a variation in the feeding rate of an average drilling machine to approximate not over plus or minus five per cent.

Several features of this circuit are worthy of attention. One is that the metering method effec-

(Continued on page 18.)

The Field for Diamond Wheels

DIAMOND wheels are primarily designed for grinding and lapping cemented carbides.

In many cases Norton diamond wheels used on cemented carbide tools are removing stock and at the same time leaving a finish that does not require subsequent lapping. As compared to a No. 60 grain silicon carbide wheel, a No. 100 grain diamond wheel 7 x ½ x 1¼" will grind the carbide from five to ten times as fast, generating practically zero heat, and leaving a plane surface that will have a taper of less than 0.0002". With a vertical feed of 0.002" for roughing, followed by a 0.0005" finishing cut, the wheel will produce a perfectly keen edge. This kind of performance is possible because the diamond grains will continue to cut through the carbide without dulling, whereas dulled silicon carbide grains must break away to reveal new grains.

Before using the diamond wheel it is essential that the steel shank be ground down practically to size. This limitation must be recognized to avoid waste of diamond grains. Steel is tough and will wear away the bond prematurely. Plants which are successfully grinding carbide-tipped tools make a practice of previously grinding the steel down to within 0.002" of size. The diamond wheel is then used to grind the carbide and take the light finishing cut on both carbide and steel. Using the diamond wheel in this way, several hours' work may be done without appreciable wheel wear. In one plant 14 tools were ground rapidly, with zero taper, and without measurable wear on the diamond wheel. When used under proper conditions much time may be saved through the use of diamond wheels. A substantial time saving is effected on the actual grinding time, while usually all lapping time is saved.

Tool Engineers will be wise to be guided by the wide experience gathered from various users of diamond wheels, who have found these precautions bring about the full value of these wheels:

1. Mount the wheel so that it runs true.
2. Keep the wheel on its individual collet until it is worn out.
3. Use on extremely hard materials only.
4. Undercut the steel shank on cemented carbide-tipped tools before grinding the carbide.
5. Be sure the grinding face of the wheel is lubricated at all times.
6. Dress the wheel if it should become loaded or glazed.
7. Operate at ordinary tool grinding speeds.

Some "Dont's"

1. Don't attempt to true the wheel with a diamond.
2. Don't remove the wheel from its collet.
3. Don't operate the wheel dry.
4. Don't grind steel or other relatively soft, tough materials, except for a light finishing cut.

Speeds—Diamond wheels should be operated at standard tool grinding speeds. Where tools are clamped to the work rest, lower speeds may be of advantage. When the rim of a cup wheel is used to grind large tools it is advisable to use a reduced wheel speed or a constant flow of coolant, or both.

Truing—Diamond wheels cannot be trued economically with a diamond. For this reason they are so finished at the factory that they can be mounted to run true. They are generally made with holes slightly oversize. After the wheel has been mounted on the spindle, the flanges should be tightened by hand. Tapping the portion of the wheel that is, "out," will quickly place the wheel in truth. Flanges should then be well tightened. To avoid injury to the wheel face, a block of wood should be used as a cushion in tapping the "out" portion of the wheel.

Lubrication—In operating the Norton diamond wheel, water is very satisfactory as a coolant if there is provision for a constant flow. If no cooling system is available, the grinding surface should be lubricated freely with a light machine oil. Through reductions in generated heat a wheel will usually last longer if lubricated with oil or cooled with water during the grinding or lapping operation.

A felt wick saturated with light machine oil will keep the grinding face of the wheel sharp, reducing heat and wheel wear.

Dressing—When used with proper and adequate lubricant, diamond wheels of correct grain size are free from loading or glazing. When allowed to run dry they may become loaded, glazed or grooved. A pumice stick or abrasive cloth applied lightly to the wheel face will remove the load.

Glazing, loading and wearing out of truth are not common occurrences with diamond wheels.

Arnold Olson, A.S.T.E. Member Passes On

The entire membership of the American Society of Tool Engineers regrets the passing of one of its good and loyal members—Arnold E. Olson, who was a tool engineer with the Kelvinator Corporation in Detroit.

Mr. Olson was born in Gladstone, Michigan and received his early education there. In 1914 he joined the Cadillac Motor Car Company as an apprentice and a student in the company's trade school. Later, he connected with Burroughs Adding Machine Company, the Lincoln Motor Car Company, the Chrysler Motor Company and Graham-Paige Motor Company. With the last named company he was Tool Engineer in charge of complete line up of tools and machinery. His last connection was as Tool Engineer with Kelvinator.

tively established one side of the work cylinder as a locked area from which a predetermined volume of oil is metered to regulate the feed rate. Therefore, any external force tending to urge the table or slide away from the pressure force is opposed by the regulator or meter system. In drilling and boring machines, this locking feature has very little value, but on some other types of machines, the feature is very desirable. The other feature to be mentioned is simplicity. One simple rotary pump, one relief valve, a directional valve, a selector valve, and a differential governor and aperture. Compare these simple mechanical parts to the previously discussed systems.

Slide: This system shown by the circuit is a metering type wherein an aperture control determines the feeding rate of traverse. A constant volume vane type rotary pump is used for both rapid traverse and feed movement. A directional valve of the spool piston type is used to select the rate and direction of flow to the traverse cylinder. A piston type relief valve is used to limit the peak pressure permissible in the system. A differential governor is used to control the pressure differential across the aperture. A two-to-one differential type of cylinder construction is used for the work cylinder.

The slide shows the various mechanisms positioned for feed rate or travel. The pump is self-priming and is therefore connected directly to the reservoir. The pump supply or volume is directly connected to the directional or selected valve. In this supply line is installed the relief or by-pass valve. The supply or volume is directed to an aperture which regulates the volume which may enter the cylinder, thus establishing a feed rate.

A differential governor is installed in the system to govern the pressure across the aperture. One end of this balancing valve is subjected to pump or supply line pressure. The opposite end is subjected to the pressure on the work side of the traverse cylinder. This end is also subjected to a mechanical factor which in this case is a spring. This spring establishes a definite differential which determines the differential pressure across the aperture.

Volume at a predetermined rate flows to the feed cylinder. The opposite end of the cylinder is open to drain through the directional valve. The differential governor, in this case, is a by-pass type. This control establishes a pump or supply pressure of approximately twenty-five pounds per square inch in excess of the pressure requirement of the feeding cylinder and fluctuation with the required pressure in the feed cylinder in direct ratio.

In examining this system, we find several points of leakage which will cause a variation in the feed rate at various temperatures and pressures. I find one point of leakage at the selector valve, another at the differential governor and another at the cylinder piston. This establishes three points of leakage. Using this circuit on the average drilling machine, a feed rate fluctuation of not more than five per cent should be easily obtained.

The several features worthy of consideration are: 1—through the use of a differential type feed cylinder, only one-half the volume is necessary for equivalent rapid traverse, as compared to the usual non-differential cylinder. 2—the differential governor of the by-pass type limits the pressure requirements to approximate the feed requirements. This lowers the heat dissipation.

The circuit shown also provides two independently adjustable rates of feed. One piece of hydraulic mechanism which has caused considerable trouble is the by-pass or relief valve. A noisy relief valve is very objectionable. This type of relief valve causes a variation in the pressure maintained and because of this clattering causes waterhammer or shock in the pipe or tubing. The waterhammer loosens pipe joints and causes leakage.

Slide: This slide shows four types of relief valves now in use. In the first valve we see a valve which is a pilot type hydraulic actuated style. A spring pressed pilot slide valve establishes the set pressure. The spring pressure is adjustable. The main by-pass piston has a poppet seat. This piston is constantly urged to the seated position by a light spring. Normally, the large area opposite the poppet seat holds the valve closed. When the small piston slide valve is depressed by excess pressure, this valve opens the large area of the poppet valve piston to exhaust. This action unbalances the valve and the pressure on the opposite side causes the valve to compress the light spring and open the poppet allowing the pressure side to exhaust to the reservoir.

The second valve is also a hydraulically actuated type. A spring pressed pilot slide valve establishes the pressure to be maintained. This is adjustable. The main by-pass piston has a poppet seat. This is constantly urged to the seated position by a light spring. The areas are equal on either side of the main valve piston. The seat side is open to pressure at full volume. The opposite side is open to pressure through a restricted opening.

When a maximum pressure is reached, the small slide valve is moved to a position which opens the main valve area opposite the seat. This allows the pressure to drop at a rate faster than can be maintained through the restricted opening. This hydraulically unbalances this piston and the pressure on the seat side compresses the light and opens the poppet valve allowing the pressure volume to dissipate to drain until a pressure drop occurs.

The third is a poppet type direct spring actuated style having a conical seat. The pressure adjustable member is the spring which must balance the hydraulic pressure area on the bottom of the cone seat. As the pressure reaches the maximum setting, the cone seat is raised which allows the volume to escape to drain. As the cone is raised, the eccentric position of the seat valve relative to the pressure chamber causes the cone to slide on a line contact on one side. This action stops the fluttering action. This valve is noiseless when used for low pressure and small volumes.

This fourth type valve is a modified slide type of relief valve. The main slide valve is spring pressed. The adjustment of the pressure is made at this spring. The spring is large and the deflection per coil is relatively large for a light load. The spring is opposed by a small diameter actuator piston. This piston area is open to the pressure side of the valve. This type is successful on pressures up to 350 pounds per square inch and large volumes.

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Standard Sundstrand 6" Stub Lathes are available in three types, each in three models. Any of these may be adapted to a wide variety of special work or combinations of operations merely by making slight alterations in the standard design. For example, consider the steering worm blanks shown in Fig. 1. It was desired to make a 30° undercut groove and finish form the taper on both ends of these pieces. By equipping our Automatic 6" Stub Lathe with suitable front and rear slides set at the required angles, as shown in Fig. 2, it is possible to do all of this work at the same time rapidly and accurately. With work between centers the operator, who can handle two of these machines, engages feed control lever to start automatic cycle as follows:—spindle starts; front slides feed in at 30° to cut grooves; rear slides, timed slightly behind those on front, feed in at 45° to form tapers; all slides dwell a moment then rapidly return to starting position; spindle stops. While this goes on, operator changes work pieces on another mandrel. Accuracy is well within required limits. Speeds, feeds, production are all high—ask us about them.

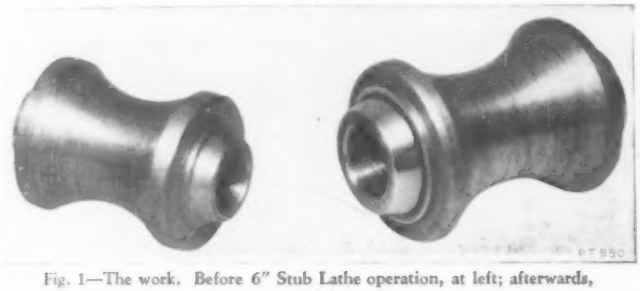

Fig. 1—The work. Before 6" Stub Lathe operation, at left; afterwards, at right.

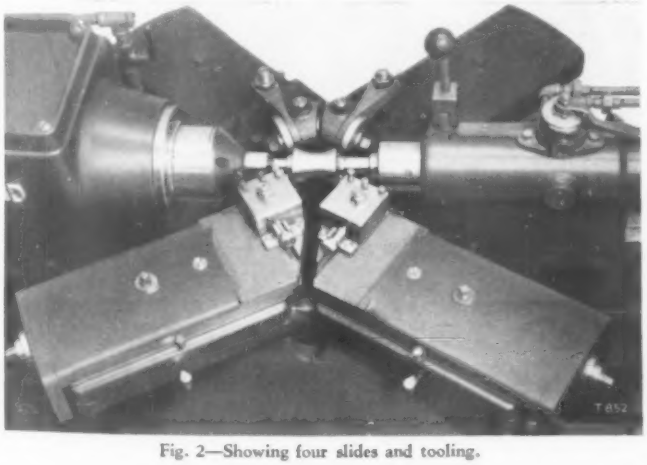

Fig. 2—Showing four slides and tooling.

Fig. 3—Automatic 6" Stub Lathe for turning work shown in Fig. 1.

This is only one of many examples of the cost-cutting production-increasing adaptability of Sundstrand Stub Lathes and Rigidmils. Let us show you others—or figure on applications to your work.

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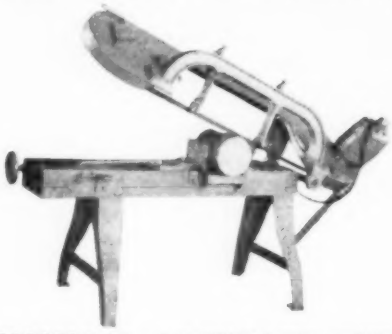

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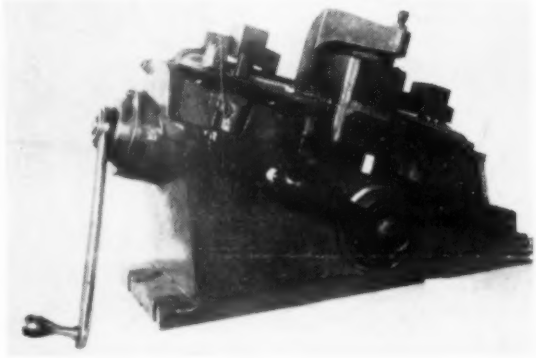
Society Acquires New Quarters--New Officers

Through the generosity of Secretary A. M. Sargent, the Society has acquired new headquarters. Many members are aware that Mr. Sargent has leased a large building located at 31 Melbourne Avenue—a short distance from Woodward Avenue. He has graciously offered for the use of the Society two excellent, good sized rooms.

These have been freshly decorated and reconditioned for the use of the Society. Hereafter the Board of Directors will meet in these quarters, and they will also be available for various committee meetings etc. The Secretary's Office will also be located here, thus centralizing headquarters for the Society under one roof.

At its last meeting, the Board of Directors, authorized the purchase of furnishings for these rooms including an ample supply of chairs. At this same meeting an election of officers for the ensuing year was held with the following results: Robert M. Lippard, President; Ford R. Lamb, First Vice-President; W. M. Gray, Second Vice-President; B. L. Diamond, Treasurer and A. M. Sargent, Secretary. A detailed account of this election will be given in the May issue of *The Tool Engineer*. These new officers will take office at the April meeting.



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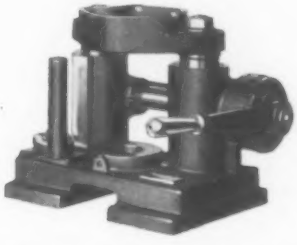

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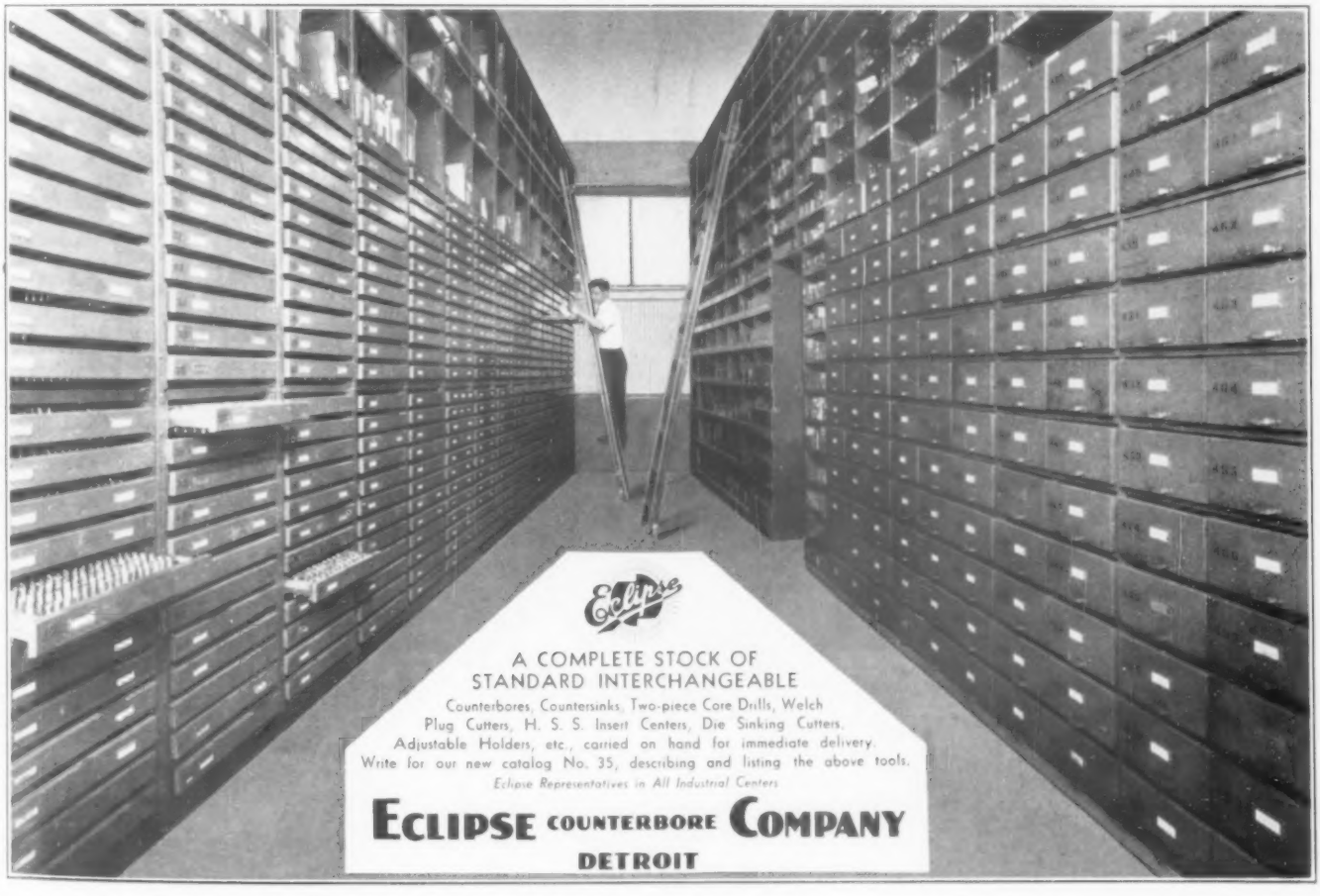
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THIS MONTH'S COVER

THE "CARBIDEBORER"—A NEW DEVELOPMENT IN PRECISION BORING

The cover illustration, this month, pictures a new development in precision boring built by the Giern and Anholtt Tool Company, Detroit and known as the "Carbideborer."

The machine is designed for production work. In every respect it is built for precision work and uses as a boring medium Tungston-Carbide or Tantalum-Carbide. It is designed to use a double V belt as a spindle pulley drive, however the spindle proper is driven by a floating key. The feed is a Vickers hydraulic system, using a Hannifin cylinder.

The picture on the cover illustrates the machine at work on gear pump bodies, finish boring a large (approximately two inch) diameter, facing the bottom of this bore, and also boring a one inch bore—all three operations *simultaneously*. All tolerances are held within two to three tenths of a thousand, *correctly*.

The "Carbideborer" is constructed to do both rough and finish boring. This is accomplished by a close coupled piloting on either or both ends of the boring tool proper.

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complete for drilling the large holes in the ends of universal joints. **Two** parts are held in the **same** fixture with **one** clamping.

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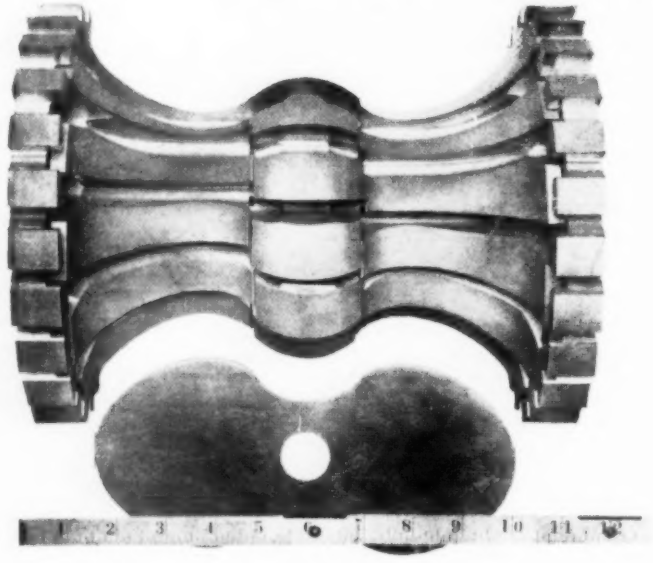

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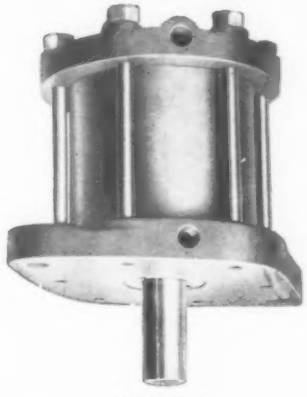

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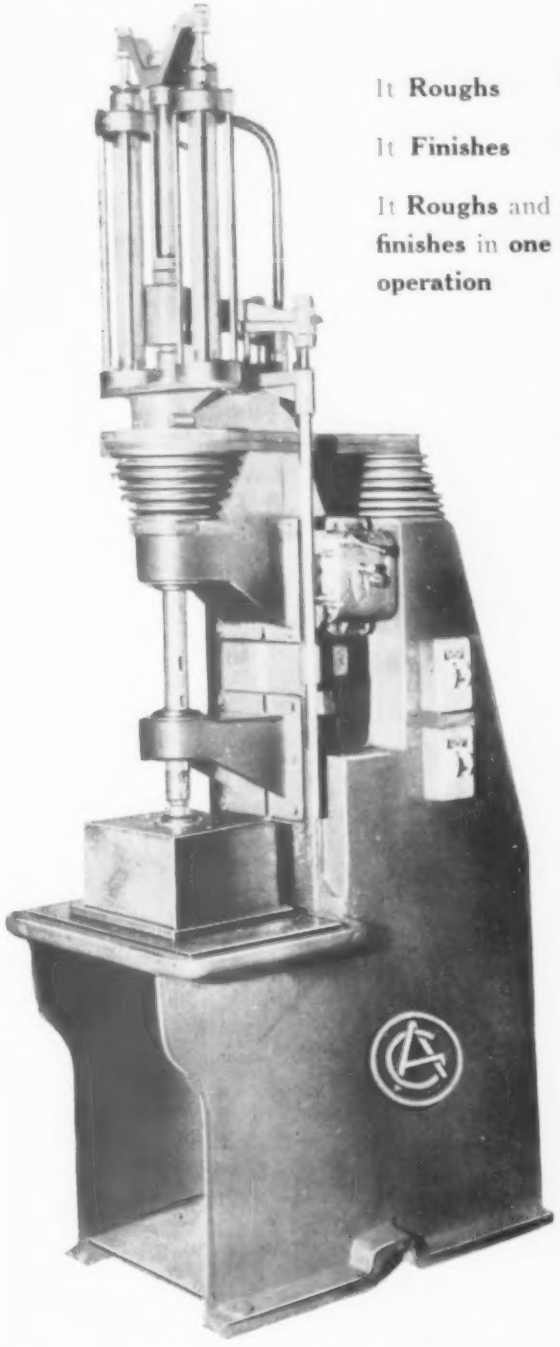

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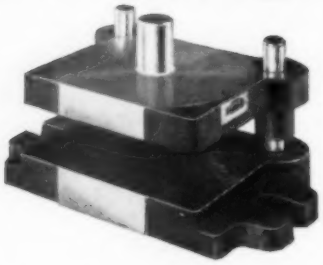

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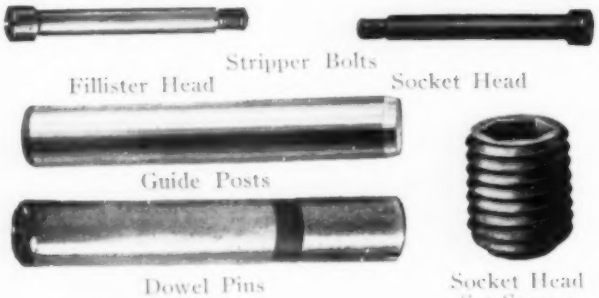

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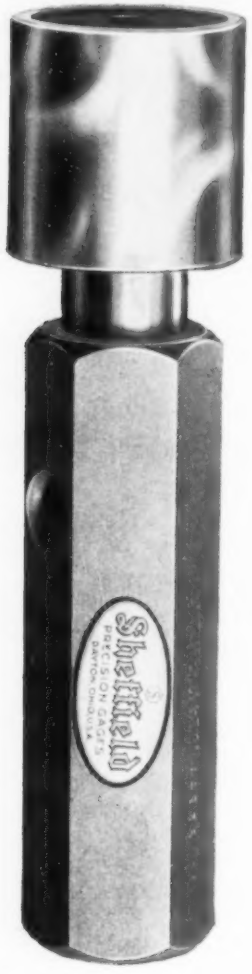

THE new Sheffield Precision Lapping Process assures not only a more accurate gage, but one having a materially increased service life—that is, lower gage cost per thousand holes.

The finest grinding operation possible will leave scratches and furrows in a gage surface. It will also temper draw the surface metal to a depth of approximately from "one to two-tenths." This soft outer layer, unless completely removed by lapping, will wear very rapidly in service. Obviously the furrows left on the gage surface will be rubbed off in the first few holes gaged.

The photomicrographs, shown, illustrate the actual surface appearance of several lapped gages. Note the striking characteristics of each in comparison with that produced by the Sheffield Precision Lapping Process as illustrated in Fig. 4.

This surface has no deep furrows. The fine lapping cuts do not run parallel to promote uneven wear. All temper drawn metal has been removed to present a surface of proper hardness and density.

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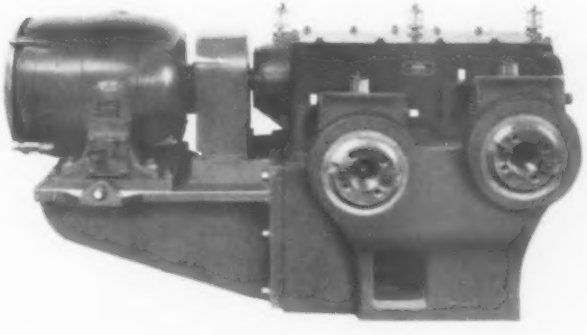

Above is shown a two spindle milling head 14 inch center distance between spindles, motor driven with pick-off gears.

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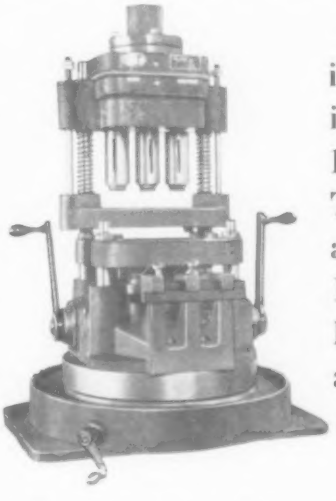

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Slide: The slide shows the hydraulic control valves used to operate an automatic fixture in which the pieces are moved into the work position, located and clamped automatically. Note that the valves are solenoid actuated. An electrical contact is also indicated from pressure at a point in the cycle.

Slide: This slide shows an electrical control panel used on an automatic machine. The panel contains complete control means, including various interlock contacts used in conjunction with the hydraulic feed and hydraulic fixture operating means.

Slide: This slide shows an electrical control panel used for controlling and interlocking a two-way machine in which one head is a hydraulic feed driller and the opposite head an electrical reversing type individual lead screw tapper. Here the combination of the electrical control is a necessary feature for the successful operation of the machine.

At this point I would like to say that I think a great many of the mechanical men should look into what the other fellow is doing. We don't appreciate what the large electrical companies have done and the great progress they have made in recent years in electrical mechanisms. It is now very trustworthy. A great many engineers are skeptical about contactors and line switch applicators. You will find them just as good and sometimes a lot better than mechanical apparatus.

Slide: You have often used and heard the expression, "It is as easy as drilling holes in a piece of cheese." Well, if you had to drill holes in cheese, what kind of machinery and equipment would you use? If you think this is a joke, look at this production machine in operation. That isn't cheese that they are working on, but it looks like it might be Swiss cheese.

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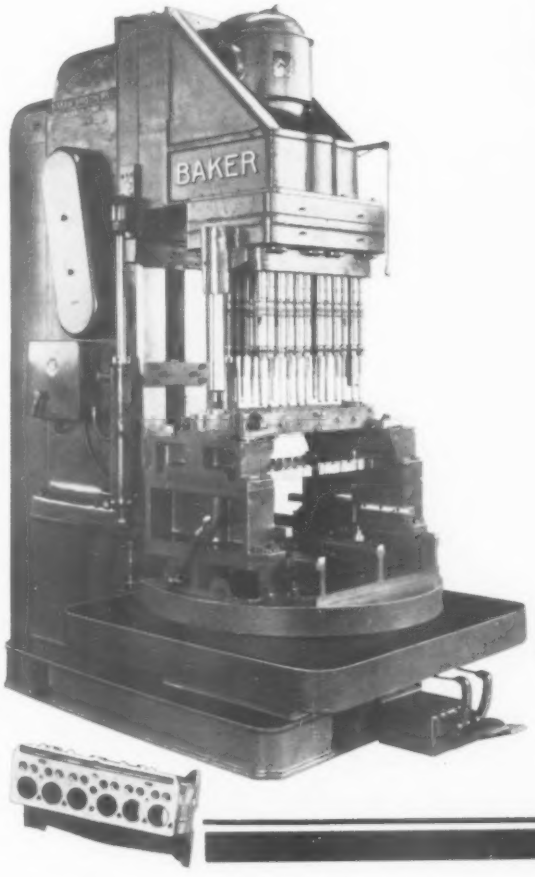

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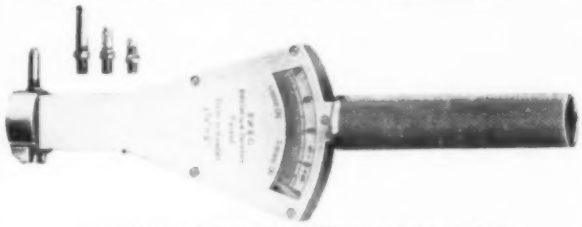

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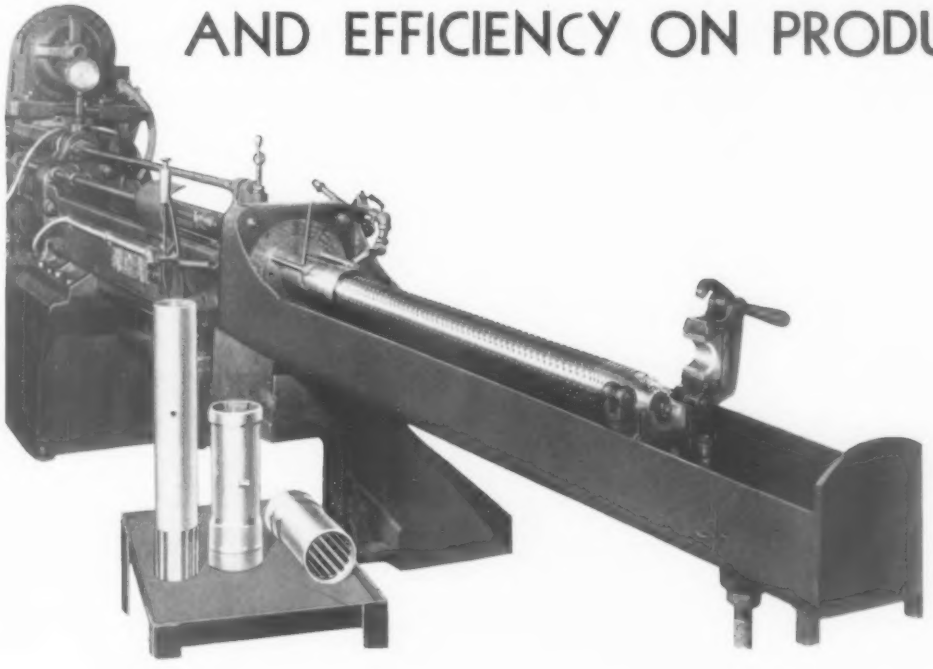
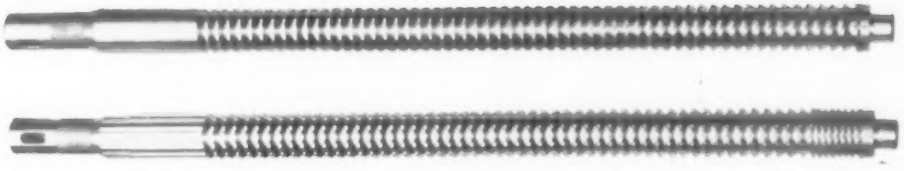


A broach installation showing a broaching machine with a finishing broach in position for finishing a shock absorber body. Two finished parts are located on the table in front of the machine.

Due to the unusually thin walls of the section to be broached, two broaches are required, a roughing and a finishing broach, as illustrated below the machine.



The initial cost of any cutting tool is not nearly so important as its unit cost and the type of part it produces. The Ex-Cell-O broach engineers are in a position to offer the necessary recommendations for designing new broaches to handle a specific operation or they can offer a solution of an existing broaching difficulty. These recommendations will be based on past experience, existing engineering standards established in our organization and standard practices in many allied fields.

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